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ABSTRACT

The purpose of this field study was to test a "macro-model" stemming from earlier research on ability grouping. Dependent process variables such as methods of instruction, and time for school and homework were studied as a function of grouping characteristics of the class. The main data are "macro" in the sense that they refer to an entire school year and are related to elementary and advanced curriculum areas and objectives. Data was collected from 46 classes in grade 11 (age 18) in five subjects. Each class was visited 4 times a year with pupils and teachers answering questionnaires about content, method, time, problems, plans and attitudes. Achievement was controlled by tests and marks. The detailed interaction pattern was subject to a parallel "micro-study" of tape-recorded lessons in mathematics from a sample of eight classes. Thus, the teachers' decisions and planning of lessons with respect to the students and the part of the curriculum under study were examined in detail. The data were analyzed by Bellack's and Flanders' systems and also by a system which included curriculum content and student reaction. All of the data collected during this field project will be analyzed with regard to theoretical considerations of frames, process, and results. The main report of the project is expected to be available in 1971. (Author/CK)

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KOMPASS PROJEKTET

Project Compass 23

~~Macro~~ and micro approaches combined for curriculum process analysis: A Swedish educational field project

Paper read at the annual meeting of the American Educational Research Association in Minneapolis, March 2-6, 1970.

Urban S. Dahllöf & Ulf P. Lundgren.

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Preface

This report is based on a paper read during a symposium at the annual meeting of the American Educational Research Association in Minneapolis, March 2 - 6, 1970.

The symposium was chaired by professor Arno A. Bellack. Professor Herbert Kliebard and Ian Westbury were the reactors to this paper. We thank them all for most stimulating suggestions for our future work.

The project reported here has been sponsored jointly by the Bank of Sweden Tercentenary Fund and the National Board of Education. The first draft of part I has been prepared by Dahllöf, and part II by Lundgren, although the final paper is our common responsibility.

We also want to thank Mrs Mavis von Proschwitz who corrected our English and Mrs Mona Möllerstedt who helped us in many ways with graphs and typing.

Göteborg, April 15, 1970

Urban S. Dahllöf Ulf P. Lundgren

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I. Main design

Introduction

The project on which we are going to report here has two main purposes, one theoretical and one methodological. On the theoretical side we are trying to test and further develop a model about the curriculum process in relation to special frame-factors such as class-size and the system for ability grouping (Dahllöf 1967, 1969). Methodologically we are trying to combine two general strategies for data collection, one "macro-approach" and one "micro-approach". Although the name of the project, Compass, is originally an abbreviation of the Swedish counterpart to Comparative Analyses of Objectives and Processes of School Systems, it should in this connection be taken literally: A compass is useful for the first orientation on new grounds and not the least when, from a new direction, one is approaching an old area cultivated by somebody else.

Although our main purpose will be to discuss the methodological problems, it seems quite necessary to outline the main theoretical background of the project. The reason for this is obvious: The factual problems and their theoretical demands are the main criteria against which we have to take methodological decisions.

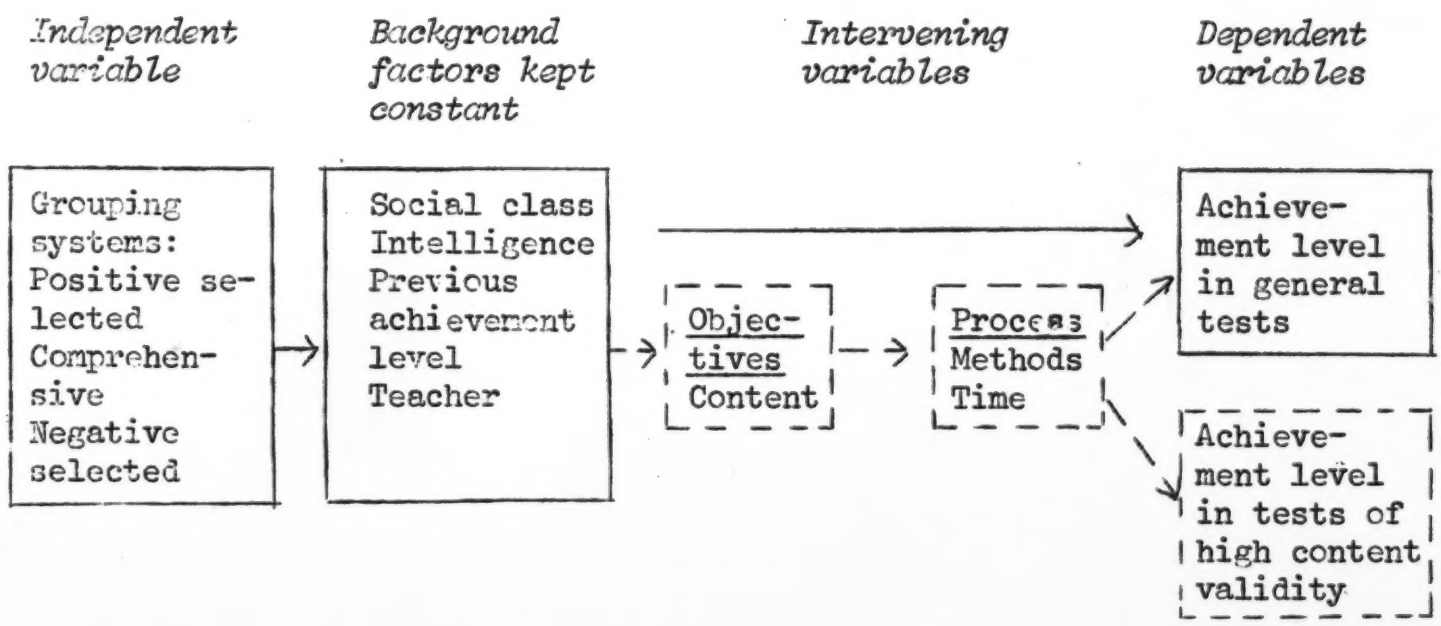
The background of the project

The starting point of the project is earlier research on the effects of ability grouping in Sweden in connection with the comprehensive school reform. The project is limited to the cognitive area. Other projects have dealt with the affective domain and problems of student recruitment to higher studies (see Husén & Boalt 1968 for references).

There is a strong need to test the arguments and investigate the different factors involved in such a complex system as schools in order to arrive at a balanced view on strengths and weaknesses as well as at a more fundamental understanding of the mechanisms that are operating in the system under varying conditions. In the area of mass-communication when changes or non-changes of society all so

often supported by sweeping statements, we regarded it as a special responsibility for educational and other social scientists to try to understand how different systems function at large and, not least, to make clear which are the key details in their mechanism of operation. A more detailed understanding of this kind will almost by definition mean a frustration for responsible politicians and so far we think we have to accept the role for sometimes being frustrators more than advocators, but we cannot see why such efforts, made in a constructive way, should not in the long run be able to provide society with better means for fulfilling its ends.

The Swedish research on ability grouping is in many ways sophisticated, especially with regard to the statistical methods of analysing data (Svensson 1962, Bengtsson & Lundgren 1968). More recently the general approach has been applied on a still larger scale e.g. in the IEA study (Husén 1967). Most studies on ability grouping may, however, be regarded as mainly descriptive of the relation between the two extremes in a complicated sequence over a quite long period of time (cf Borg 1965, Goldberg, Passow & Justman 1966, Yates 1966). In the Stockholm study by Svensson (1962) the dependent variables were assessed almost two school after the date on which the independent variables - teaching in positively selected, comprehensive and negatively selected classes - were put into action (fig. 1). From another project - a series of curriculum studies with a quite different purpose (Dahllöf 1960, Husén & Dahllöf 1960, 1965) - we happended, however, to have access to systematic data on the educational process within the same school-forms. The present project started when we later tried to put these data in between the independent frame factors and the dependent achievement test data. The process data contained information about (1) the general method of teaching (class-centered or individualized), (2) the contents of the instruction and (3) its approximate taxonomical level as well as (4) the time taken in terms of the number of lessons spent on different curriculum units.


Independent variable
Background factors kept constant
Intervening variables
Dependent variables
Grouping systems: Positive selected Comprehensive Negative selected
Social class Intelligence Previous achievement level Teacher
Objectives Content
Process Methods Time
Achievement level in general tests
Achievement level in tests of high content validity

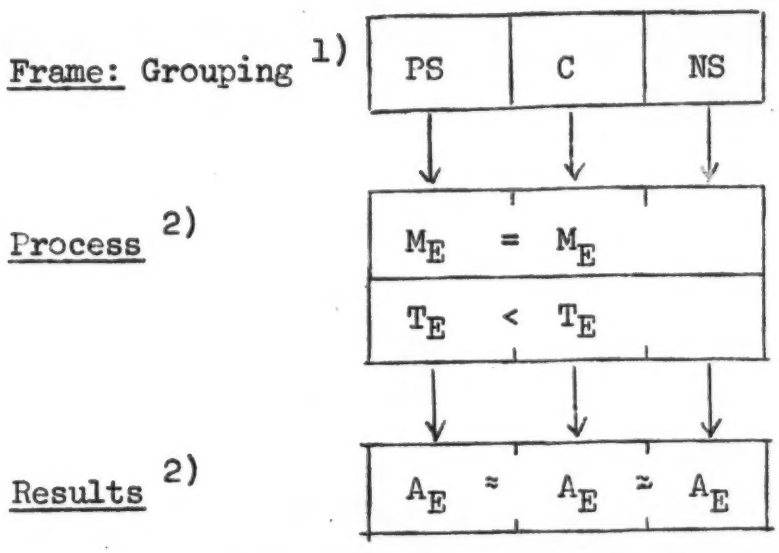
Solid lines: Factors considered in traditional research

Broken lines: Factors of special interest for future research

Fig. 1. A general paradigm shcwing the relation between the independent variable and teaching process, achievement and objectives in research on grouping (From Dahllöf 1969)

The findings have been published elsewhere (Dahllöf 1967, 1969). The main outcome of the study may be summarized as follows: (1) The tests measured only very basic skills and had so far low content validity. (2) Traditional class-centered instruction was the main teaching pattern in both school environments studied. (3) In elementary functions almost the same level of achievement was acquired by pupils of equal initial ability and social background in the two systems, but behind this equality there are considerable differences in time: the number of lessons for the positively selected classes was much less than for the comprehensive setting (cf. fig. 2).

The final outcome of the first study referred to here is a systematic model - or preliminary theory - about the general relationship between (1) environmental frame-factors like ability grouping and class-size, (2) contents and objectives, (3) general teaching pattern, (4) level of achievement and (5) time for reaching this level of achievement for (6) pupils of equal initial ability and social background in (7) classes of different composition (Dahllöf 1969).



1) PS = Positive selection
C = Comprehensive
NS = Negative selection

2) A_E = Achievement in
M_E = Method of teaching
T_E = Time for teaching
} elementary curriculum units

Fig. 2. Main pattern of findings in the Stockholm study (Svensson 1962) supplemented by curriculum process data (Dahllöf 1967, 1969).

One important concept in the model is the steering criterion group, i.e. a group of pupils in the class that - according to empirical indications - when traditional class-centered instruction is the main teaching pattern, is acting as a reference group for the teachers' pacing the instruction for the whole class. This is discussed more fully later on.

In general the model may be regarded as an application of the Carroll (1963, 1965) model of school learning and of the Bloom (1968) mastery learning concept in a specific situation and under limited conditions. Since the Carroll and Bloom models were not known to us when the first analyses of the process data started in 1963, our findings represent a somewhat independent contribution to this field, approaching the problem area less from a psychological and more from an educational - sociological direction. We should also refer to the importance of classifying the curriculum contents with regard to taxonomical level as demonstrated for example by Bloom et.al. (1956) and Scriven (1967).

The theory is preliminary for two reasons. It is limited with regard to subject matter area, since the process data on which the first version of the model is resting come from Mathematics, a highly structured subject. To this can now be added, however, that we have recently completed a new study in which we tested directed hypotheses derived from the first study on data from a much vaguer subject, viz. the mother tongue, in this case Swedish. Although the findings, as expected, did not show up as great differences as in Maths, the basic structure of the model was confirmed (Dahllöf 1970 a).

The other reason for our stressing the preliminary state of the theory is of a methodological kind. All process data were collected through questionnaires to teachers who had to give ratings of the approximate amount of time spent on different specified curriculum units going back over the whole preceding school year. Although reliabilities and validities were quite sufficient for group comparison purposes, much more relevant information could obviously be collected, especially about the amount of homework, that up to now is taken into consideration only theoretically. The follow-up study in Swedish allowed us also to investigate differences between classes of varying initial ability within the same school-form, so far as the standard of the class was subjectively perceived by the teacher. It is enough to say, that in this respect the findings were also confirmative.

General considerations behind the new project

So far all empirical work on the model has been done on data collected from field projects designed for other purposes. Facing the need for new empirical data to test and further develop the model, we have to report quite briefly some general considerations behind the new study.

(1) For several administrative reasons we were not in a position to set up any experiments.

(2) For similar reasons we took the decision to make the new field study on the high school level corresponding to grades 10 - 11 when the students are generally 17 - 18 years old (Swedish schools start at 7). This means that the new study was done one step higher up in the system than that on which the model was orginally developed. It will also be more difficult to test the model here since the senior high school or the gymnasium is a positively selected

school-form, which considerably narrows the range of variation between classes.

(3) There had recently been a reform of the high school also, so neither teachers nor students were quite familiar with the new system. Thus there was at the same time a need to study the actual teaching of the new curricula also as a part of the program to implement the reform (cf Dahllöf 1970 b).

(4) Swedish schools are highly centralized. The main goals and general structure of tracks and options as well as the main objectives and curriculum contents in every subject are decided on by the Ministry of Education and Parliament. Thus there is in every subject just one curriculum or syllabus all over the country. In addition to this the National Board of Education issues general directions and planning guides for the teaching of the different subjects. The teachers are free to choose their methodology, to structure and pace the instruction, according to their own judgment. The choice of textbooks, of which there is generally a variety, is made by consensus among the teachers in the same grade in a local school within a certain range, set by the local school authority. It is generally taken for granted that the text-books determine to a high degree the contents and sequence of teaching but this is not necessarily always the case. The main norm influences on the teacher as a decision maker may thus be illustrated as in fig. 3.

(5) For the ultimate theoretical aim of the study the independent factor is the frame conditions under which the class is operating during the school year with regard to the student characteristics. This may be regarded as a part of the environment. We have, however, made a rough division between on the one hand the general environment e.g. the region, the cultural climate, the social and economic conditions etc. in the neighborhood and on the other hand such factors as may be regarded as direct and immediate frames for the teaching situation. Such frames may be physical - e.g. large or small schools - or administrative e.g. teacher utilization, class-size and social and other characteristics of the class. Common to the so-called frame factors are, among others things the fact that they can be changed by the local school authorities but not by the individual teachers. Once established, they act as quite fixed frames for a considerable time, at least a school year but very

often more. This time may be longer for school buildings but shorter for class size and group characteristics. It is true that classes change their characteristics also during the semesters owing to immigration, illness and the like and this is one of our minor methodological problems. But on the whole, most students belong to the same class over the school year. There are several measures of class characteristics to be used as the independent frame variable, such as general intelligence and prior achievement level but also social background and attitudes.

(6) In this connection it ought to be mentioned in passing that the study has been carried out in Göteborg, an industrial city of about 450 000 inhabitants. The social stratification is relatively marked, which in our case means that the correlation between intelligence and social background drops to about zero when it is calculated over class means. Thus there are classes of high intellectual standard combined with both high and low social background as well as the reverse.

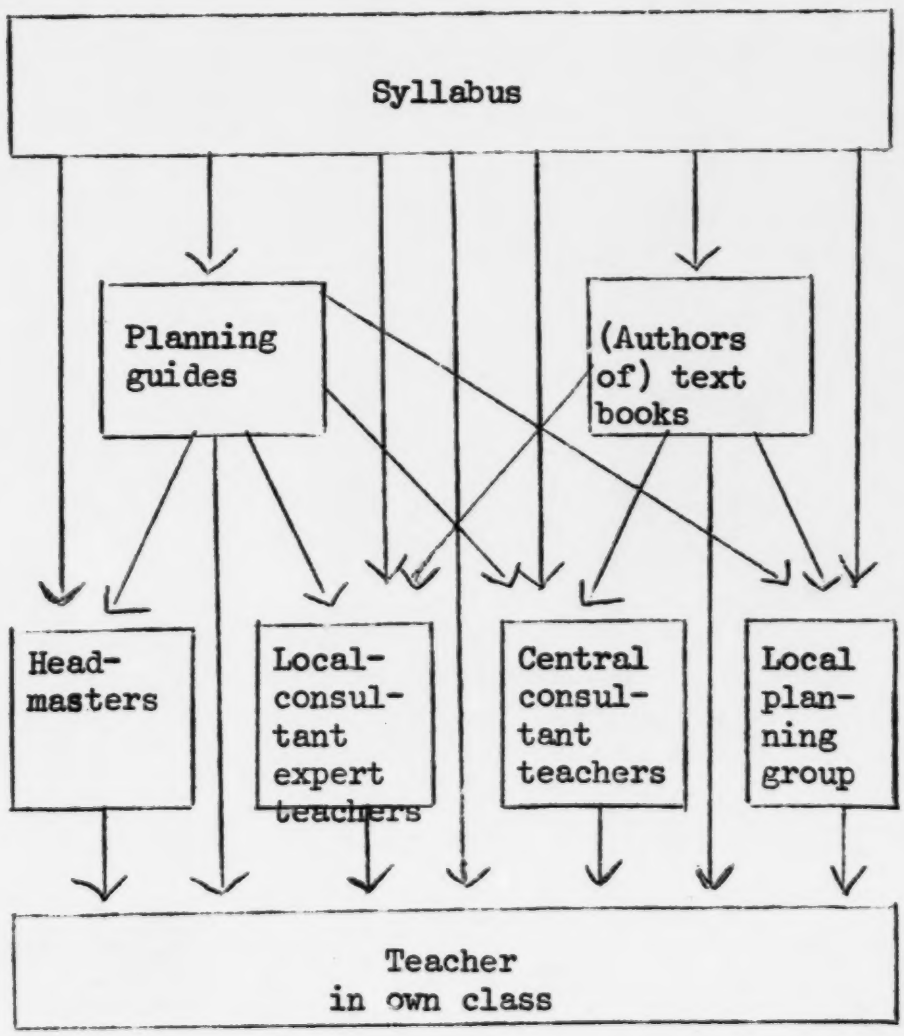


Fig. 3. *A general paradigm of the relation between syllabus and teachers in Swedish schools.*

The main design

The general plan of the study resembles a three-stage rocket (fig. 4). The teaching process is investigated in grade 11 in two of the four tracks of the senior high school that begins in grade 10. In this grade most of the background information of individuals and classes was taken for pupils in all tracks in this school form. Thus there was a so-called basic data study in the fall semester 1967, comprising an intelligence test battery as well as a personal data form and attitude questionnaires. Moreover, most students in this generation had been subject to an intensive study also in grade 8 and 9 in another project, Youth in Göteborg, dealing with the problems of adolescent culture (Coleman 1961, Andersson 1969). We will also follow up the final outcome in grade 12 in terms of the students certificates.

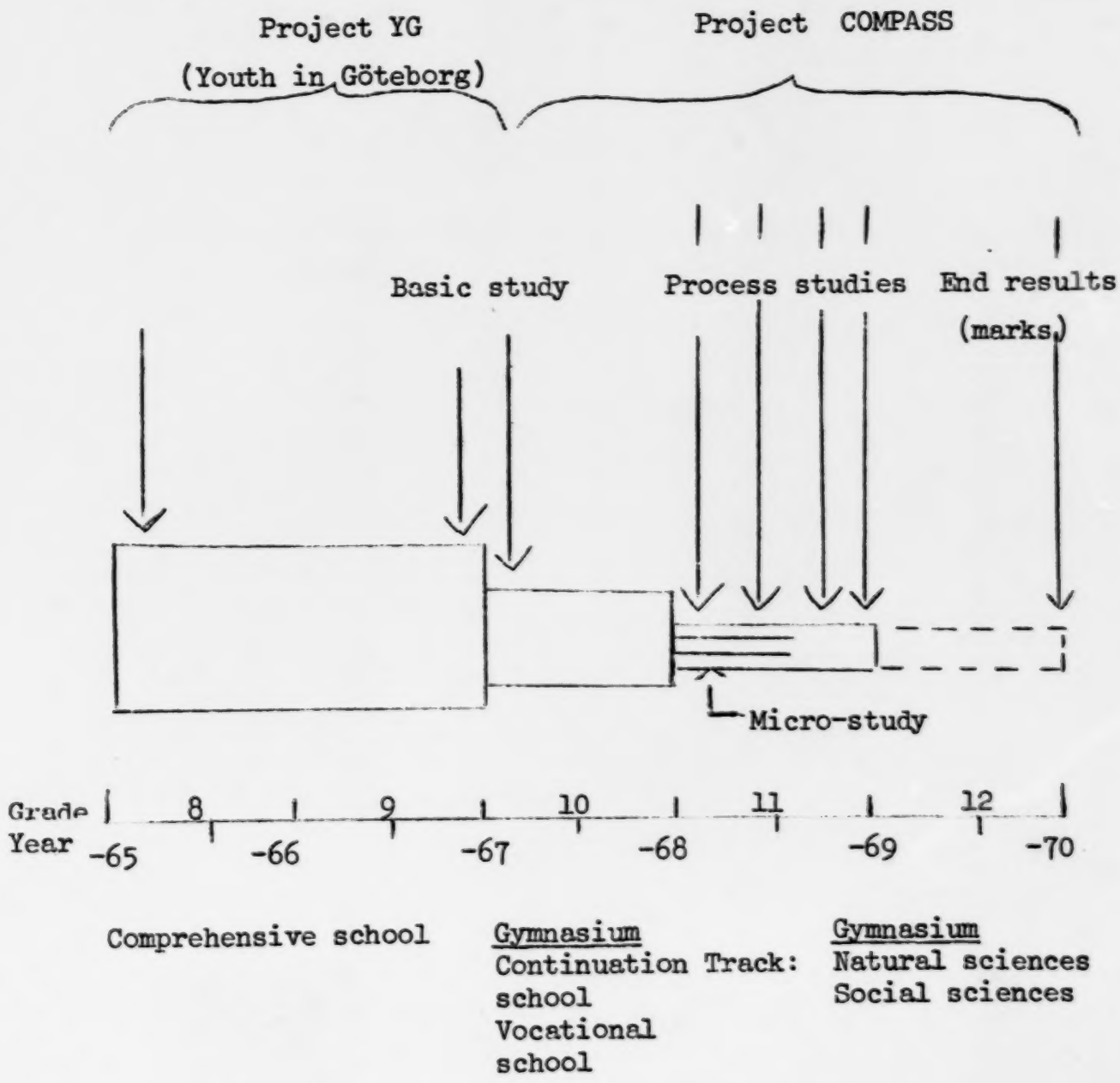


Fig. 4. *Main design for the Göteborg-study of the Compass project and its relation to project Youth in Göteborg (YG).*

Let us now look at grade 11. The so-called macro-approach covers all classes in the two tracks over the whole school year in five subjects: Mathematics, History, Civics and the literature courses of Swedish and English. The micro study is done in one subject (Maths) in a smaller number of classes over the fall semester.

Before we analyse the detailed design, we had perhaps better discuss the "macro" - and "micro" terms as indicators of different approaches. As here conceived, they stand for extremes in one dimension. The use of them is also relative to the special research field. From the point of view of social economy or educational planning, our macro-analysis would, indeed, be a micro-one. On the other hand what is here regarded as a micro-approach would be a macro-one for most researchers in the field of the psychology of learning.

In this case the distinction between macro and micro is in the first place made with regard to research technique and time-span covered. Most process-directed research in Education, e.g. classroom interaction studies by means of audio or video-tapes, generally analyses a limited time-span or a small number of subsequent lessons in the same class. On the other hand, the information for every lesson is extremely detailed. In relation to this approach our need for process data to be related to studies of a sociological type about the impacts of different environments or frames, no doubt may be said to be on a macro-level. In the new field project, however, we need more details about the process over the school year. There is one characteristic of traditional classroom instruction that is of central importance for our model. By definition, class-centered instruction may be regarded as a teaching pattern, in which the teacher addresses the whole class for every new curriculum unit. Individualization may occur, but only within a certain unit (or theme). Since the model assumes that the level of objective in basic or elementary parts of a subject is generally the same, this means that the more clever students have to wait for their slower class-mates before they can proceed to a new unit. When one puts together different studies on grouping, there is an indication that the pace of teaching in the class-centered pattern is, at least to some extent, determined by a special category of students that act as what we call a "steering criterion group" or reference group for the teachers decision to go ahead or not. For elementary units, at least in highly structured subject like Mathematics, this group seems to be located somewhere in the region

of the 10th or 25th percentile in the distribution of the pupil in the class.

The main reason for our decision to include a micro-study is to see if an interaction pattern, corresponding to this steering-group hypothesis, could be identified. Most of the existing systems for analysis of classroom interaction do not regard the teaching content nor its taxonomical level as very essential. Neither do they control with whom among the students the teachers is interacting in a given phase of the instruction. In our case we are, of course, especially interested in the interaction pattern in the so-called transition stage between two curricula units. Therefore, in order to be able to relate our micro-study to the macro-data we have to include in a systematic way information about content area as well as identifying all individuals taking part in the interaction.

The design in detail

If we project the school year in grade 11 on a somewhat larger scale (fig. 5), we can perhaps better understand how the two approaches supplement each other..You have the Swedish school year on a time scale from the end of August to easrly June. There is a break for the Christmas and Easter vacations. Since every lesson in a given subject has the same numberof hours week during a semester, we know beforehand the approximate number of lessons in this subject during a certain period. The small lines in the center of the figure may be regarded as a lesson. Sometimes they are combined in a double-lesson, even though this is not shown in the picture.

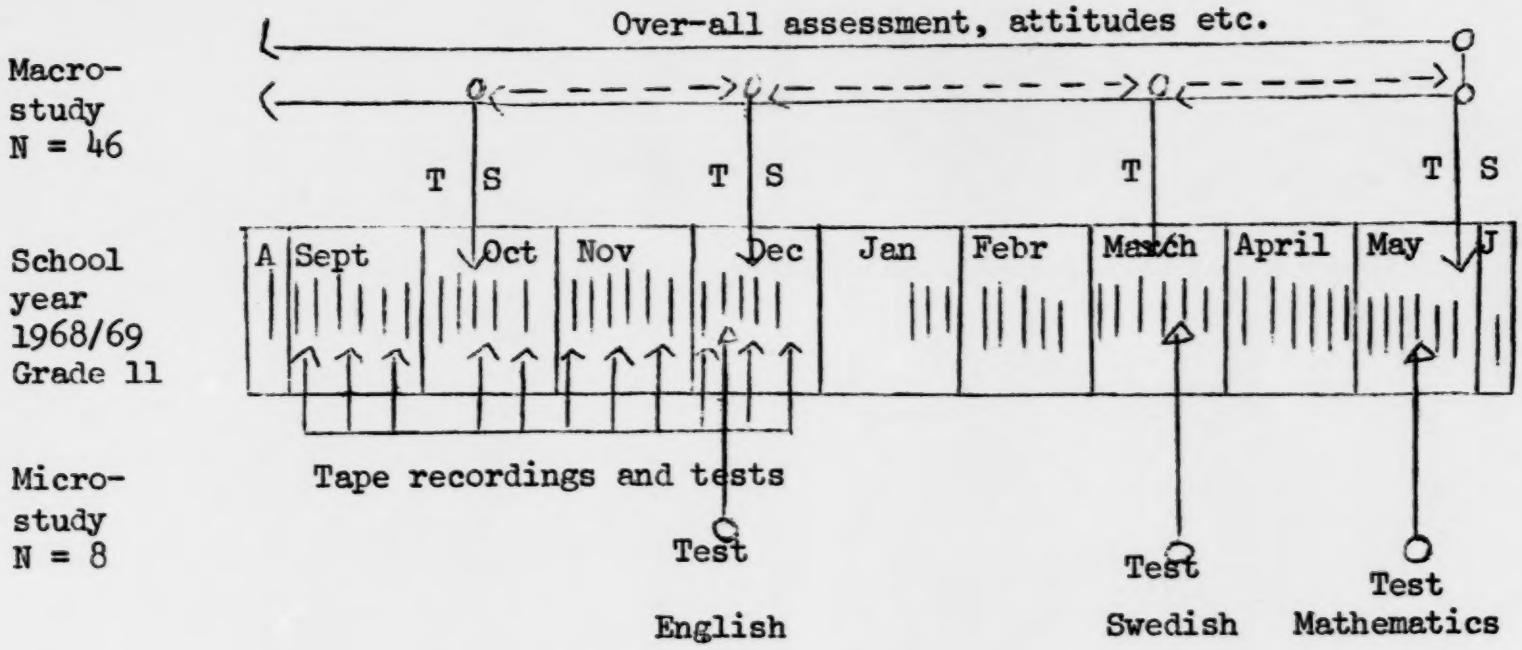
The macro-approach is shown in the upper end of fig. 5. Each of the 46 classes was visited by our team on four occasions during the school year, in early October, December, March and May. On three of these occasions both students (S) and teachers (T) responded to questionnaires. On one of them (in March) we approached only the teachers to save costs and time.

We knew beforehand what text books were used in each class. With the text book as a frame of reference for the teacher, he (or she) was asked to tell us what the class was dealing with just now and by what methods this was done. We also asked them to indicate the actual amount of teaching different curriculum units included or not included in the text book since the beginning of the school year. In addition to this, we

asked them to tell us their plans for the immediate future and to estimate what part and how much of the syllabus they expected to cover within a certain period of time.

On the next visit the actual fulfilment of these plans was checked through new retrospective questions for the preceding period, plans for the new period were asked for etc. At the end of the year, there were additional over-all assessment and attitude questions included.

The students were indicating what they were doing in the specific subject at the time of our visit, their amount of homework and their way of doing it, their attitudes towards school, teachers and teaching methodology etc. In one of the subjects, Mathematics, eight classes were studied by an observer and a tape-recorder every third lesson. This is the micro study, which will soon be discussed more fully.



Solid lines: Actual teaching
Dotted lines: Planned teaching

Fig. 5. *Detail design of the Compass-study.*

Variables

Thus, planned and actual teaching time for different curriculum units are the main dependent variables in the macro-study, that are going to be related to the pupil recruitment of the class with regard to initial intellectual abilities, keeping social background and other similar variables constant. We are of course also interested in the social background as a frame factor and a source of variation to the teaching process. Preliminary data suggest that we will perhaps be able to make a more complex

analysis at least on the student data. We have collected some achievement data primarily for control purpose, but this time the process data are our main concern. For a well defined group like this, knowing the process does allow a fairly good prediction of achievement level, whereas it is not so easy to predict the process from test data.

In order to exemplify the variables, we have in tab. 1 - 2 listed the main variables in the questionnaires from the basic study in grade 10 and from the process data studies in the fall semester in grade 11. Of course the data from grade 10, when used as frame variables in grade 11 have been corrected for changes in the classes between the grades. Data from grade 8 - 9 are generally not included in tab. 1.

Tab. 1. *List of frame-variables, calculated for classes and schools.*

Students´background

Sex

Age

Class and school in grade 10, 9 and 8

Social background
- Father´s occupation
- Father´s school career
- Mother´s occupation
- Mother´s school career
- Social group index derived from parents occupation and education

Students´initial abilities

Sum of marks from comprehensive school (grade 9)

General intelligence (group test)
- Four sub-tests
- Verbal score
- Non-verbal score
- Total score

Final marks in grade 10
- Marks in each subject
- Mean of total marks

Students´attitudes

Choice of school-form in grade 10
- General attitude towards Continued education
- Change of school form
- Reasons for choice
- Time of decision
- Discussions with parents, schoolfellows and teachers etc.

Study technique and work load
- Present work load in relation to expectations
- Degree of expected success
- Parents´attitudes in case of failure
- Own attitude towards failure

Subjects and choices in grade 11
- Change of school form
- Preferred subjects
- Choice of tracks

Teachers in all schools (actuarial data)

Sex

Age

Formal training

Formal position

Teachers in "macro-classes"

Sex

Age

Basic training

Additional training

Subjects and marks from the university

Length of service

Formal position

Tab. 2. *Extract of process variables from October questionnaire in grade 11.*

Teachers	Students
Prior teaching	
Amount of repetition of syllabus for grade 10	
Curriculum units treated since start of the semester Specifikationin relation to text book Sequence used Amount of time for each unit	
Present teaching	
Present curriculum unit: Topic for last lesson in this class	Present assignment in relation to text book
Last home assignment Day Contents Relative difficulty Students´achievement Students´estimated attitudes Planned time for ordinary student	Last home assignment Day Subjects Amount of time for preparation (several questions) Study technique
Planned teaching for next period	
Curriculum units to be covered Specifikation in relation to text book Sequencing Amount of estimated time	
Methods in general	**Attitudes**
Number of lessons up to now of different types (Examination of homework and common preparation/ group-work/discussions/individual assignments etc.)	Attitudes towards schoolfellows teachers school in general
Assignments for bright students	Interest in specific subjects
Ways of handling weak students	Changes in interest since grade 10
Types of examinations	Difficulty of subjects
Attitudes toward types of examination	Teachers´pacing of present contents earlier contents
Planning home-assignments in cooperation with students or not	Participation during lessons
Changes in homework due to total load	Tactics before examinations
	Way of preparation of long home-work and piece-work

Population and response rates

All classes in the two tracks within the city of Göteborg were included in the study. Table 3 shows the number of teachers and their response rates in the different process data studies.

Tab. 3. *The teachers and their response rates in the macro process data studies.*

		Resonse rates. Per cent.			
Subject	N	P1	P2	P3	P4
Mathematics	42	81	74	64	64
Civics	19	95	95	84	89
History	47	85	83	74	68
Swedish	47	74	64	61	61
English	47	85	74	74	77

The response rates decrease over the school year. The level is acceptable at least for the fall semester when the "macro" data are to be compared with the "micro" data.

The number of students is shown in tab. 4. The testing program was carried out on ordinary lessons, so the figures in the first place reflect the ordinary illness-frequency. The gross number of students contain all pupils who have belonged to the class at all at any time during the school year, the net number those who have left the class with a final mark.

Tab. 4. *The students and their participation in the macro-process data studies.*

Track	Classes	Students		Participation: Per cent of gross no.		
	N	Gross N	Net N	P1	P2	P4
Social	19	475	462	78	83	78
Science	27	737	709	90	85	82
Total	46	1212	1171	-	-	-

The participation is satisfactory especially in the science track during the fall (P1, P2). Of course the total number of students participating in all data studies is much lower, but that figure does not need to be high for the purpose of our analyses.

Finally tab. 5 shows - for the science track (Na) - the distribution of class means in total intelligence scores in relation to an index of social groups in terms of the numbers of pupils in each class belonging to social group I (the highest one).

Tab. 5. *Distribution of classes with respect to intelligence and social group. Science track (Na). Absolute numbers.*

Per cent social group I.	Intelligence: Below median		Above median		Total
64 -	-	6	2	7	13
48 - 63	2		2		
32 - 47	4		3		
16 - 31	6	7	6	7	14
0 - 15	1		1		
Total	13		14		27

Thus, we have the opportunity of comparing the teaching process of all combinations of intellectual standard and social group within classes. The general hypothesis to be tested is according to the model that - given an equal level of achievement in elementary curriculum units between classes - the time for teaching them is shorter in the classes characterised by positive frame conditions. It has to be observed that we also have access to direct attitude measures (cf. tab.1) that may be treated as "climate" frame factors.

Since the analysis of data has to consider the pattern of assumptions and subgroups at the same time in order to allow any conclusions about the basic model, it is not meaningful to illustrate the data treatment by single questions or subgroups, not even for illustrative purposes only. Therefore we must refrain from any report on findings in this connection.

II. The "micro" approach

Introduction

The idea about a certain steering group, mentioned above (of Dahllöf 1969), was one of the starting point for the intenseve "micro" study. If the teacher is using the achievement level of some students as a criterion for the pacing of the teaching in elementary units of the curriculum, there are perhaps other groups which play other roles in the teaching process. Bellack et.al. (1966) and Flanders (1965), among others, have shown that the teaching process follows a fairly established pattern of rules, in which the teachers have the dominating and rule-deciding part. The teaching pattern seems to a great extent to be a mirror of the teacher´s concepts of the class based on his imagination and experience of the students.

For a teacher who is teaching just one subject in many classes, it seems impossible to have an opinion about every single student. With respect to the objectives the teacher has to make some kind of "subjective" grouping of the students. This means that he addresses different groups in different phases of the teaching process and gives these groups different roles in respect to the goals. Students in these groups can change. The steering group in elementary units can be seen as a "subjective" group in the teacher´s conseption of the class, which for him has an important role during some parts of the process - when working with elementary units.

These very tentative hypotheses were steering the direction of our "micro" study. Early in our planning we were influenced by the research from Flanders (1965), Bellack, Kliebard, Hyman and Smith (1966), Herbert (1964, 1967), Amidon & Hunter (1967), Biddle (1967) and Stukàt & Engström (1966,1967).

More recently, in the development of our category system and, above all, in our further teoretical considerations the research made by Jackson (1968), Smith (1962.), Smith & Geoffrey (1968), Honigman (1967), Hubbard-Jones (1969) and de Landsheere & Bayer (1969) have played important roles, Of course also other researchers have been of importance but those mentioned above to come closest to our approach.

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Design and population

From the classes included in the main study ten classes were sampled. Two criteria were used for this sampling, viz.
a. the mean and distribution of the students´initial abilities
b. the text book used in the class.

In the first run the classes were picked out in order to get as great differences as posible between classes in the ability variable. Among these classes, nine were picked out which had the same text book and one which had a very similar text book with respect to contents and structure.

The teachers of Mathematics in these classes were contacted early before the fall semester. The project was presented to them,the teacher´s role in the study was discussed. Only one of the teachers refused to participate in the study, referring to an overloaded work situation.

The micro-study had been preceded by som pilot studies in which different types of instruments for observation had been tried out (Ternéus 1967), Among these methods we tried a self-rating system with the aid of a diary. This method promised very much in the beginning, but proved heavy for the teacher and disturbed his way of teaching. The best method to use for observation of the teaching process seemed to be a non-participating method either by tape-recording or by an observer.

We tried to concentrate the observations to one curriculum unit, the concept of derivata. This unit was in most classes planned to be treated at the end of the semester. Thus there was time for testing the instruments and training the observer and - above all - for familiarizing the pupils and the teachers with the observations.

The observer was a gratuate student in education, who had also studied Mathematics.

The first 8 observations were made with the aid of the category system developed by Herbert (1964), in some respects modified by us. There were, however, considerable difficulties with regard to those aspects of the process that were most important to us and the reliability became low. The following observations were therefore made with the aid of a stereo-tape recorder.

Two microphones were used, one for the teacher and one for the students. The microphones were placed in the windows of the class-rooms. In fig. 6 we show an ordinary classroom and the arrangements of the microphones.

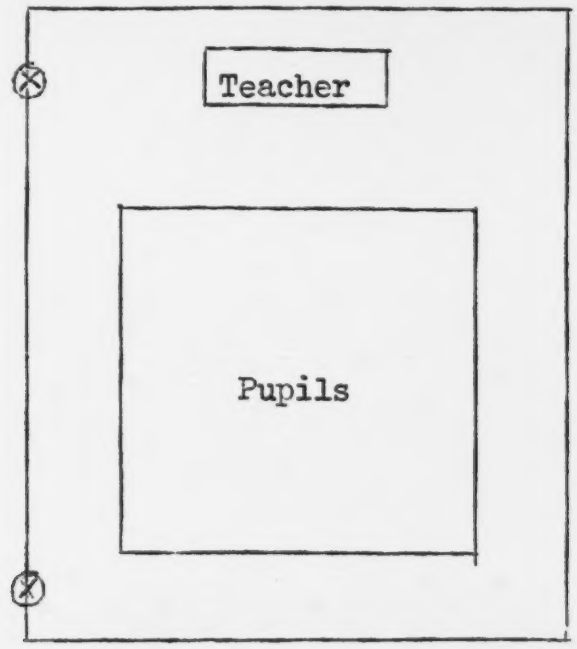

Fig. 6. *An ordinary classroom with the two microphones.*

The quality of the recorded sound was high. Parallel to the recording, the observer had to notice who was speaking and for how long time. He also made notes on activities that were not verbal but of importance for the verbal process. All in all, 64 lessons were recorded. Four of these are not possible to code because of technical faults in the recording. Parts of the lessons have disappeared and in that case nothing is coded. But for these four lessons we still have the observers´notes of what happened, which students were involved etc.

In table 6 is shown the number of lessons for each class, the mean for the class in an intelligence test (WIT) and the class size.

Tab. 6. *The classes in the micro study.*

Class	Number of students			Intelligence	Number of observations with		
	Total	With marks	Tested	Mean	Herbert´s system	Recor- dings	Observa- tions only
1	28	26	21	61.2	1	7	-
2	27	26	25	61.3	2	8	-
3	31	30	26	64.1	-	1	-
4	24	21	19	69.2	-	7	-
5	20	20	14	66.1	1	5	3
6	30	30	26	59.7	2	10	1
7	31	30	25	61.6	1	7	-
8	30	30	29	58.7	-	8	-
9	31	31	27	61.6	1	8	-
Total	252	244	212	62.2	8	61	4

As is shown in table 6 we have two different measures of class-size. The first column refers to the total number of students that during this year belonged to the class and the second column shows the number of students that got final marks at the end of the school year. The differences between the total number of students and the students with marks give the number of students that have dropped out during the school year. For one of the classes just one lesson is recorded. The teacher in this class refused to allow a tape-recorder but permitted other types of observation.

Neither the teachers nor the students knew when the observer was coming. The lessons recorded were concentrated to the part of the semester when the derivata concept was taught. We also tried to get an over-representation of double lessons, when one lesson is immediately following the other in the same subject. In the pilotstudies the teaching structure seemed to be quite different during double lessons compared with single lessons.

We also tried to allocate the observations over the entire semester. In table 7 the lessons observed are tabulated with regard to class and time for observation.

Tab. 7. *Observations in relation to time and class.*

Class	Week no.												
	39	40	41	42	43	44	45	46	47	48	49	50	Σ
1		1H		1r	1rd		1r		1r	1r	1r		8
2	1H	1H		1rd	1rd			1r	1rd		1rd		10
3			1r										1
4			1rd					1r 1rd		1r	1r		7
5	1H		1r 1o				1r	1r		1r 1o	1o	1r	9
6	1H	1H	2r				1rd	1r	2r 1o	1rd	1r		13
7		1H					1r	1r	2r	1rd	1r		8
8		1r		1r	1r		2r	2r	1r				8
9	1H	1r	1rd	1r			1rd	1r		1r			9
Σ	4	6	9	5	4	-	9	10	9	9	7	1	73

H = Observations with a modification of Herbert´s system

r = Recorded lesson

rd = Recorded double lesson

0 = Observers note only

In the first hand we will analyse the 60 recorded lessons in the eight classes.

Additional data

For all students and teachers involved in this study we have data also from the process study. In table 8 response rates for the students are tabulated.

Tab. 8. *Response rate for the students in the micro study on the macro process questionnaires.*

Class	Popula-	Response rate in per cent				
	tion N	P1	P2	P4	All P	Any P
1	28	96.4	96.4	50.0	50.0	100.0
2	27	88.9	74.1	81.5	55.6	100.0
3	31	87.1	80.6	77.4	51.6	100.0
4	24	70.8	70.8	62.5	45.8	91.7
5	20	56.7	56.7	50.0	33.3	66.7
6	30	86.7	86.7	76.7	66.7	96.6
7	31	90.3	87.1	83.9	70.9	96.8
8	30	100.0	80.0	80.0	63.3	100.0
9	31	74.2	83.9	80.6	41.9	100.0
	262	83.6	79.8	71.8	53.4	94.7

Of the 262 students who belonged to the classes during the school year 248 had answered at least one of the questionnaires in the macro process study. The response rate during the fall semester (P1, P2) varies between 84 and 80 per cent. Two additional types of information have also been collected, viz.

a. achievement tests and
b. interviews

Achievement tests have been administered in the first week of the fall semester as well as during the semester. The first test covered the syllabus for grade 1. When the teacher found that his class satisfactorily mastered the curriculum unit, he called upon the project staff and the other test was given. This test was not to take too much time from the teaching. Every student was given just one item from the text book according to a method developed by Lord (1959 a, 1959 b) (cf. also Husek & Sirotnik 1968). In this way we have a fairly good picture of the achievement of the class. This is supplemented by the standard test (see fig. 5) which will be analysed on an item level.

At the end of the school year, we also followed up these classes with a one hour interview with the teachers. In this interview we tried to measure the teacher´s opinion of the class and how he experiences the observation. We also tried to get a categorization of the students in the class and what kind of "subjective" grouping of the students the teacher had in mind and the roles of such groupings.

Coding

The main analysis will be made with the recorded lessons as the basic unit but some questions will also be followed up in the two other types of data. When we started coding the recordings, we tried to find a general category system which covered both cognitive and emotional aspects of the verbal interaction. Another criterion for the system was its applicability to the data collected in the macro-study. Even if no system wholly covered all the aspects, two systems seemed to be fairly general and possible to use. These were Bellack´s (1966) system on the cognitive side and Flanders´(1965) on the affective side. With these two general systems as a basis, we have, however, made several modifications with respect to our type of problem.

The recordings have been treated as follows:

1. Every lesson was type-written - on a draft level
2. The draft was corrected with regard to obvious errors
3. The observer filled in his notes
4. The final version with notes was mimeographed

The main unit in the coding (Norvell 1969) is the move according to Bellack´s terminology. But we have defined the concept somewhat differently from Bellack. Thus we sometimes code a move even within one sentence. As an illustration we will take following example.

T:	When was the battle of Hastings?	SOL
P:	1069	RES
T:	No, /the battle of Hastings is one of the most	REA
	important battles in the history of Europe	STR

According to Bellack this last sentence would have been coded as only one move, viz. REA.

The differences between our way of defining moves and Bellack´s will in the first place affect the number of moves. Thus, we will have an over-representation of the structuring move in comparision with Bellack. The moves are

the main unit in our analysis and every move will be coded with respect to the following:

1. Identity. Number of moves etc.
2. Period of phase in teaching
3. Agent
4. Addressee
5. Nonverbal soliciting
6. Verbal/nonverbal activity
7. Pedagogical move
8. Substantive meaning
9. Substantive logical
10. Instructional meaning
11. Instructional logical
12. Time in seconds between moves
13. Time in seconds for move
14. Cycle
15. Flanders´system

These categories are commented upon below.

Period of phase in teaching refers to Flanders´(1965) system for classifying activity periods. Five periods will be used,

"a. settling down to work
b. introducing new material
c. teacher-directed discussion work on material that is new
d. supervision and direction of individual seatwork, and
e. periods of evaluation, in which homework and test results are discussed." (Flanders 1965, p. 22.)

These phases also correspond to a question in the main study where the teachers had to estimate how much time they spent on these activities.

Agent and addressee - Every student has a code number similar to the one used in the main process study.

Nonverbal soliciting refers to the situation when the student raises his hand or in some other way is calling upon the teacher to pay attention to him and get him involved in the interaction.

Verbal/nonverbal activity - We are coding as moves even nonverbal activities, if they are important for the teaching process. An example: If a student knocks at the door because he arrives late, attention will be paid to him

by the whole class. This is coded as soliciting move.

Pedagogical moves are used exactly in the way Bellack has defined them but with one exception. Another move is included which has been coded as HEP. This category is used when a teacher is helping a single student, walking around in the classroom. The move can be verbal when the teacher explains something that is not intended for anyone else. It can also be nonverbal when the teacher calculates or writes something. Mostly we have a combination between verbal an nonverbal activities. This move is more similar to a cycle and will be analysed separately from the four main moves. The frequency of HEP move indicate roughly the degree of individualization.

Substantive meaning just refers to whether the interaction is about Mathematics or not.

Substantive logical is used as by Bellack, but the category "defining" has not been divided in denotative or connotative.

Instructional meaning is also used according to Bellack but we have not divided the category "action" into sub-categories.

Instructional logical is used in a similar way to substantive logical.

Time for and between moves has been registered and the total sum in seconds will give the absolute time for the lesson. This measure will allow us to calculate the length of pauses between moves, which is particulary important in our way of defining cycles.

Cycles will be defined in the same way as by Bellack, but the cycles will also be classified according to time between moves. The move HEP is analysed as a separate "cycle,.

Flanders' system will be used as described by Flanders (1965). As this system has been used for sampled observations, there will be differences in using it on moves.

The coding of these data is now being carried out. Three coders are used, one for the cognitive system, "the observer", one for the affective system and one for the time measure.

A description of the teaching in one class

In order to give an idea of what these lessons look like, we will here give some data from one of the classes. The class is perhaps a little odd compared with the others since the total number of moves is very low. But it will, anyhow, act as an illustration of our system and as a basis for discussion.

The teacher is a young woman. Her main subjects are mathematics and physics. Beside this class which she is teaching for five hours a week, she teaches mathematics in four other classes, physics in two classes and an orientation course in science in one class.

In the interview she describes the class as intelligent and pleasant to work with. "I have not taught in grade 2 before, but I think is a relatively good class. They are jolly good and hard-working and there are no problem with discipline either. They are nice and good I think. I think it would have been much more difficult if I had had another class which was not so good ..... We have compared their achievement tests and have had the same tests in parallel classes and they seemed to be better than the others".

But the students´interest in the subject does not correspond with the teacher´s opinion in the interview. At the end of the fall semester 56 % of the students described Mathematics as less interesting or very uninteresting in comparison with their expectations before the semester.

In table 9 we have tabulated the responses for the class on the following question:

"How interesting do you find the following subjects in comparison with your expectation in the beginning of the semester?"

Tab. 9. *Interest changes in four subjects during the fall semester. Responses in December related to beginning of the school year (N = 28).*

	English	History	Swedish	Mathematics
Much more interesting	-	4	-	-
More interesting	19	26	15	26
As interesting	59	52	67	18
Less interesting	15	18	18	49
Much less interesting	7	-	-	7
Total	100	100	100	100

Compared with other classes, this class seems to be quie ordinary. Their interest in Mathematics has been somewhat decreased during the semester when the observations were going on. The teacher is, anyhow, satisfied with the class and its work.

"This class has learned to think critically, they pay attention to find gaps in the presentation in the text book ... they dont accept everything and they are a little creative I think".

On the question if the recording disturbed the work, the teacher answered: "I don´t think so. Perhaps on the first occasions the children were a little upset since a person came with cables and such things, but then I didn´t think about it. I was a little hesitant in the beginning, I didn´t know what it was like, but I didn´t think about it later on, it didn´t matter".

Altogether seven lessons were recorded from this class, of which one was a double lesson. I all 526 moves were elicited. In table 10 we have tabulated the number of moves for each lesson.

Tab. 10. *Number of moves and their distribution over lessons.*

Lesson	N	%
1	180	34
2	79	15
3	69	13
4	19	4
5	51	10
6	42	8
7	86	16
Total	526	100

Lessons (3) and (4) form the double lesson. Only four of the moves are nonverbal but of importance in the teaching process. The teacher has 59 % of the moves, the students 28 % and the move HEP amounts for 13 %. On the four nonverbal moves one is a soliciting move (knocking at the door), three are reaction moves (the student refuses to answer on a soliciting move from teacher). Even if it is not correct to compare this class with the Bellack (1966) study, we will only as an illustration make a preliminary comparison.

Tab. 11. *Comparisons between class No. 1 and Bellack's (1966) study. Per cent.*

Moves	Class No. 1		Bellack (1966)		Diff. %
	N	%	N	%	
STR	71	15.5	854	5.7	+ 14.8
SOL	172	37.5	5 135	34.2	+ 3.3
RES	95	20.7	4 385	29.2	- 8.5
REA	121	26.4	4 649	30.9	- 4.5
Total	459	100.0	15 023	100.0	

As we predicted, we have a higher number of structuring moves. The differences are more marked if we compare the distributions of moves between students and teachers.

Tab. 12. *Comparisons between class No. 1 and Bellack's (1966) study for students and teachers. Per cent.*

	Class No. 1			Bellack (1966)		
Moves	Pupil	Teacher	Total	Pupil	Teacher	Total
STR	8.5	91.5	100.0	12.0	86.0	98.0
SOL	18.0	81.0	100.0	14.0	86.0	100.0
RES	77.9	22.1	100.0	88.0	12.0	100.0
REA	33.1	66.9	100.0	19.0	81.0	100.0
Total	32.9	67.1	100.0	38.2	61.7	100.0
Moves N	151	308	459	5 910	9 565	15 023

Even if there are differences, the similarities are amazing. Bellack et. al. study was done in International Economic Problems in American high school classes and our study is about teaching derivate in a Swedish gymnasium: The stability of classroom verbal behavior patterns over time, which Hoetker & Ahlbrand (1969) have shown, is perhaps the same over countries and school systems. Even if we don't dare to interpret any results in this stage of our data treatments, we want to underline the necessity of explaining these patterns in terms of the teachers imagination of himself, the students and the curricula.

Flanders (1965) has shown that there exist a clear connection between

teacher influence and teaching outcomes. In the Bellack et.al. (1966) study was this connection not so clearly proved. Bellack et.al. summarize their findings in the following way:

"It is unlikely, however, that any single dimension of classroom discourse described here will be found to have a consistent relationship to any single dimension of learning. Rather, it seems likely that further studies might seek to identify clusters of variables - types of teaching profiles - that might possible be related to certain outcomes." (p. 235).

In combining Flanders category system for classifying the affective dimensions of teaching with Bellack´s et.al. cognitive system we are making such a clustering suggested by Bellack et.al. (1966).

Even if we not in this presentation are able to relate this combination in a meaningful way to learning outcomes we can show how Bellack´s system can be combined with Flanders´category system. In table 13 we have tabulated the number of moves of each category in Flanders system.

Tab. 13. *Moves in relation to Flanders´(1965) system.*

			N	%
Indirect influence	1. Accepts feeling		3	.6
	2. Praises or encourages		25	4.8
	3. Accept ideas		25	4.8
	4. Ask questions		91	17.3
Direct influence	5. Lecturing		100	19.5
	6. Giving directions		57	10.8
	7. Critic rising		7	1.3
	8. Student talk	Response	105	19.9
	9.	Initiate	42	7.9
	10. Silence or confusion		4	.8
	HEP		67	12.7
	Total		526	100.4

In table 14 we have compared the pedagogical moves with Flanders´system. The teacher uses a little more direct influence than indirect. The two most frequent categories used by the teacher are asking questions and lecturing which seems pertinent with the verbal pattern described with Bellack´s et.al. system.

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In table 15 Bellack´s system is related to Flanders´category system.

Tab. 14. *Pedagogical moves in relation to Flanders´categories for class No. 1. Per cent.*

	Flanders´categories											
Moves -	1	2	3	4	5	6	7	8	9	10	Tot.	N
STR				2.8	77.5	11.3		8.5			100.0	71
SOL	.6	.6	.6	48.3	6.9	23.8	1.2		17.4	.4	100.0	172
RES	1.1	2.1	2.1		11.6	3.2	2.1	75.8	2.1		100.0	95
REA	.8	18.2	18.2	4.9	18.2	4.1	2.5	22.3	8.3	2.5	100.0	121
HEP	100.0											
Tot.12.7	0.6	4.8	4.8	17.3	19.5	10.8	1.3	19.9	7.9	0.8	100.0	

As we can see, all moves, except the reaction move, have a very restricted range in comparison to Flanders´categories. The reaction move is the only move that covers all categories and has a wider distribution of the frequences. If we cluster the categories in type of influence (tab. 15) we shall find that the teacher has a higher proportion of direct influence, but that the differences are small between indirect and direct influences. In respect to pedagogical moves, however, there are marked differences. In relation to the structuring move the teacher has a high proportion of direct influence. These differences seem logical in respect to the definition of categories.

Tab. 15. *The proportion of direct and indirect influence in relation to pedagogical moves for class No. 1. Per cent.*

Moves -	Indirect influence	Direct influence	Student	Silence or confusion	Total	N
STR	2.8	88.8	8.5	-	100.0	71
SOL	50.1	31.9	17.4	.6	100.0	172
RES	5.3	16.9	77.9	-	100.0	95
REA	42.1	24.8	30.6	2.5	100.0	121
HEP 100.0						67
Total 12.7	27.5	31.6	27.8	.8	100.0	526

The move HEP indicate a special teaching method when the students work and the teacher walks around helping. This HEP move dominates the second lesson of the double lesson and the number of HEP moves also increases during the semester. In only two of the seven lessons there is no HEP move (lesson 2 and 3).

Concluding remark

We have in this paper given an overview and a description of the COMPASS-project. Up to now, our data are ready for computer treatment. For every student, class and school we have stored our data on discs. We are using the ISR [1)] data system in cooperation with the Computer Center for Higher Education and Research at the University of Göteborg. The system has been modified for our purposes by Mr. Sten-Olof Brenner and Karl-Lennart Nilsson. The latter is responsible for our present data processing.

In the first hand we will analyse our macro data according to our basic theory in frames, process and results. In the next step we will follow the results found down in the micro-study, down into the single lesson and the single class.

The last phase in our analyses will be the teacher interviews combined with results from the observation study. We will then reach the end of the way from broad data about the educational process over a two semester period to the teachers´and the student´attitudes, opinions and behaviors in the single lesson. At that stage we hope that our compass is sufficiently calibrated for new research efforts.

According to our present plans the main reports of the project will be published during 1971.

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